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Oregon Agricultural College

Experiment Station

Department of Horticulture

Strawberries

By

C. E. SCHUSTER
Assistant Horticulturist, (Pomology)

CORVALLIS, OREGON

The regular bulletins of the Station are sent free to the residents of Oregon who request them.

SUMMARY

Strawberries need a soil that is fertile, three to four feet deep, with good soil drainage, and located in frost-free sites.

Soil fertility is easier increased before planting than after. No one commercial fertilizer can be recommended for strawberries under all conditions. Barnyard manure is nearly always beneficial.

Varieties should be chosen according to market demands. The standard varieties grown do not need cross-pollination.

Obtain healthy, vigorous plants. Use the hill system. Plant early, and pack soil well around the roots.

Cultivation should be frequent and shallow to conserve moisture. Irrigation is valuable where it can be obtained.

Do not plant too large an acreage for the labor available.

Berries should be picked when dry and should not be bruised. They are picked at different degrees of ripening according to the uses they are intended for.

Intercropping of strawberries among fruit trees is profitable if sufficient space is left between the strawberries and trees.

Insects and diseases can be controlled commercially by a rotation of crops, in which the berries are allowed to bear two years.

Everbearing strawberries are valuable in districts of late spring frosts, or in other districts where there is a sale for them at a high price during late summer and fall, or for home use.

Strawberries

Strawberry culture in Oregon has been increasing rapidly the last few years, having more than doubled from 1919 to 1921, and more plantings are being made. With the increase in acreage has come the entrance of new varieties into the field and the appearance of new problems connected with the culture and marketing of strawberries. This bulletin is intended as a summary of results obtained by experimental work at the Oregon Experiment Station and by the experience of successful growers throughout the state.

SOILS

Any soil that has good fertility, good drainage, is of a reasonable depth (three to four feet deep), and easily cultivated will produce strawberries profitably if climatic and other conditions are suitable. While a sandy loam is undoubtedly the soil best adapted to raising strawberries, they will grow on a wide range of soil; that is, some variety may usually be found that will do fairly well on almost any type of soil except the very heaviest or very poorest of soils. For commercial production, the heavier soils such as "white lands" or adobe should be avoided. There is too much land in the state that is well suited to strawberry growing for any one to risk success by planting on soils naturally not suited to the strawberry.

SLOPE AND LOCATION

Since the flowers are produced so near the ground, the strawberry is very susceptible to frost, and for that reason should be placed in as frost-free a location as possible. A slight elevation above the surrounding territory, with a good even slope for air drainage to lower levels, will at times mean the saving of a crop from frost. Low, level sites at the foot of slopes are especially subject to frosts. Other local conditions besides a good slope, such as the presence of large bodies of water, local air current, or the presence of fogs, may render a location relatively frost free, making it very desirable for strawberries.

A sloping piece of ground will serve to minimize the danger of frost, and is equally valuable in obtaining good water drainage. Although the plants want a plentiful supply of moisture throughout the year, they will not endure a great amount of standing water. For this reason we find that strawberries do not thrive in poorly drained locations where the soil is water-logged throughout the winter and early spring, preventing the free entrance of air into the soil and retarding root activities.

For early berries for the fresh trade a southern slope on a sandy loam soil is best. The northern slopes are cooler and as a result the blossoms are held back until the danger from frost is lessened, thus serving well for mid-season and late berries.

SOIL FERTILITY AND ITS MAINTENANCE

The fertility of a soil should be as high as possible before the plants are set, as the strawberry planting lasts but a short time. It is easier and more economical to increase the fertility before rather than

after setting the plants. Most of our soils originally contained a sufficient supply of all essential plant foods, though successive cropping may have reduced certain elements such as nitrogen and phosphoric acid to a point where the addition of these elements to the soil is necessary for profitable crop production.

While we want for strawberries, soils that are rich in plant food, the elements should be as nearly as possible in perfect balance. An over supply of one plant food or a deficiency in another will throw the plant foods out of balance and give undesirable results in plant growth or fruit production. A soil that has been steadily cropped may become deficient in one plant food, and the result may be a poor growth and a small crop. On the other hand too much plant food of one kind may be present or injudiciously added and a wrong stimulus be given; e. g., an oversupply of nitrogen is apt to cause an overvigorous vegetative growth with a resulting light crop of soft, poorly colored, and poorly flavored berries. When a soil becomes depleted in some plant food, steps may be taken to build up the supply by application of manure or commercial fertilizer.

Manure. The application of barnyard manure is nearly always beneficial as it supplies humus as well as plant foods to the soils. Possibly its biggest addition to the soil is the humus, as this will greatly increase the water-holding capacity of the soil; and a soil full of humus, that will hold moisture late in the season, is necessary for the production of high class berries, especially in non-irrigated sections. The decomposition of vegetable matter or humus also aids in liberating other plant foods already in the soil but not in a form available to the plant. The manure should be well rotted and as free as possible from weed seeds to avoid fouling the soil with obnoxious weeds. Humus can also be added by plowing under green cover crops such as vetch and oats before the plants are set.

Commercial Fertilizers. Where soils are becoming depleted and the supply of barnyard manure is insufficient, the use of commercial fertilizers may become necessary. In any soil-fertility plan the use of commercial fertilizers should be held as secondary to the use of manures.

The only way to be reasonably certain that a fertilizer is needed and will be beneficial to the soil is to test it out by means of small test plots. Equal-sized plots should be laid out in the field where the same soil conditions can be had for all plots. The plots can be rows of a definite length using nitrogen. phosphorus, potash, and combinations of the three on separate rows. Untreated rows should be left at intervals, so that by observation one can determine the benefits of any one of the fertilizers applied to the individual rows and whether one or more plant foods is missing from the soil. The use of a complete fertilizer may mean the addition of a plant food with which the soil is abundantly supplied. If one certain fertilizer gives results proportionate to its cost that particular one, only, need be added.

In fertilizer tests carried on by the Experiment Station, nitrogen has been the plant food most often missing and nitrate of soda the fertilizer that gave best results. From one hundred to two hundred pounds to the acre is the usual amount used. The nitrate can be broad-

casted, taking care not to allow it to fall and lie upon the leaves on account of danger of burning. It is not necessary to work it into the soil as the rain will quickly dissolve it if the application is made early. An application during March or several weeks before blooming furnishes the added stimulus that aids in producing vigorous growth and a good crop. Three to four hundred pounds of superphosphate will furnish the required amount of phosphorus, while one hundred to one hundred and fifty pounds of muriate of potash will furnish the potash if these plant foods should be needed. In non-irrigated sections, these two fertilizers should be applied at the same time the nitrate is used, but in irrigated sections they can be applied when needed.

The use of lime has failed to pay for the cost of its application in all experiments that have been carried on. Strawberries want a soil with a slight acidity rather than a soil that is neutral or inclined to be alkaline. Attempts to sweeten the soil by the application of lime may result in entirely removing the acidity of the soil and in creating conditions directly opposite to those needed by the strawberry.

PREPARATION OF THE SOIL

Strawberries want a loose, friable soil, which can best be obtained by planting after a rotation of crops and immediately following a cultivated crop. Following a sod or hay crop in some sections of Oregon the soil is very likely to be infested with grubs, and in localities where the white grub is prevalent it is best not to plant strawberries until two years after a sod or hay crop has been turned under. Deep plowing and thorough working of the soil to a good depth before planting are essential, as this will be the last time deep cultivation can be had for strawberries.

VARIETIES

In planting strawberries the variety planted should be chosen with regard to the available markets. The prospective grower should investigate the markets available and having determined which one he wishes to supply fruit to, should choose a variety or varieties best adapted to that market. Several of the varieties grown are not entirely satisfactory for all uses.

The varieties best adapted to this section are few in number, and of this number four originated in Oregon: Magoon, Clark's Seedling, Gold Dollar, and Oregon. Two other varieties that are being planted to a certain extent originated in California, Trebla and Ettersburg No. 121. It would appear that varieties originating locally are better adapted than those imported from a distance.

The varieties listed are what are known as perfect flowering varieties, and there is no need of cross-pollination. Since there are no varieties of any importance grown in Oregon that are imperfect in their blossoming, the question of cross-pollination need not trouble any of the growers unless they obtain a variety from another district. In obtaining new varieties for trial in any section care should be taken to determine whether they are perfect or imperfect blooming varieties. Commercially, an imperfect variety is one with only pistils in the flower, while the perfect varieties have both pistils and stamens. In catalogues

these differences are noted by P. or Per. for perfect varieties and I. or Imp. for imperfect varieties. If a variety is marked I. or Imp. a perfect blooming variety must be planted with it at the rate of one row of the perfect variety to two or three rows of the imperfect variety.

In experiments carried on with the Ettersburg No. 121 in 1921, it was found that the use of pollen from other varieties did not increase the size of the berries or advance the time of ripening. Interplanting of varieties would not tend to increase color, quality, or size.

Of the varieties listed, the Trebla and Ettersburg No. 121 plants are very large and very vigorous. The others are medium to above in size and vigor.

Gold Dollar. Below medium in yield. Fruit medium-sized, dark red, only medium quality, early. Recommended for early-trade shipment for short distances as fresh fruit. Is ten days to two weeks earlier than other varieties and valuable from this standpoint.

Magoon. Heavy yielder. Fruit large, dark red, about medium quality; mid-season to late. Too soft for commercial canning or long-distance shipping. It has been considered a good berry for home use and short distance hauling, but is being displaced by the Oregon. In some cases it is taken by the canners. Under very favorable conditions this variety shows a tendency to produce a light crop in the fall, but should never be classed with the everbearing variety.

Marshall. Fruit medium to large; medium to dark red. Flesh soft, quality medium to excellent; yield medium to below; mid-season.

This variety is very exacting in its requirements and often in many localities not satisfactory in its behavior. Recommended for home use only or local use in short shipments, except in certain localities. Where it yields well it is proving fairly satisfactory as a canning berry.

Oregon (Improved Oregon, New Oregon). Quite similar to the Magoon in general characteristics but lighter in yield; has a longer bearing season and will also produce a light crop in the fall. It is only suitable for short-distance shipments and home use. Probably the best of mid-season berries of this type.

Clark (Clark's Seedling). Fruit medium in size or below, dark red, very firm and solid; mid-season; quality medium; yield light. This is the best berry for long-distance shipping and one of the best canning berries we have. Unfortunately it is one of the lightest yielders on the list and is only grown on account of its shipping qualities, though it brings in as much money per acre as any other variety we have where it can be shipped in car-load lots. Unless the locality has large enough acreage to furnish shipments in car-load lots this variety is not recommended for planting. Neither is this berry recommended for home use or cannery use on account of its light yield. It seems to have a preference for the lighter soils.

Wilson. Fruit medium size, dark red, firm; quality below medium. Yield medium, mid-season. Good for shipping and canning. This variety requires very fertile soil and does best on virgin land. On poor land or land that has been farmed for some time it is generally unsuccessful. It can only be recommended for a few localities with soils of the foregoing characteristics, where it can be sold to a cannery. It is not

satisfactory for local fresh markets on account of its poor quality. For shipping it is surpassed by the Clark.

Ettersburg No. 121. Fruit medium to below in size; bright red color; very firm and solid; quality good; mid-season to late; yield heavy. This is the best variety to plant as a canning berry since it is firm, has a red color clear through, and gives heaviest yields of fruit. This variety has many terminal flowers that are imperfect, with the female parts abnormal. In many cases this has caused much dissatisfaction. It seems to need the lighter soil, for where it is grown in very fertile soils that are rich in nitrogen the plants develop vegetatively and produce a light crop of poor berries. Where it is allowed to follow its natural tendency to set many runners, the crop following this large set of runners is very adversely affected.

Trebla. Similar to the Ettersburg No. 121 in general characteristics, but without the objectionable features of imperfect flowers. It is reported in California that this variety is an ever-bearing variety. It has the tendency to turn very dark in the cans if not picked at the proper time and for this reason is considered not so satisfactory as Ettersburg No. 121.

PLANTING

Plants. Plants should be obtained from some source that is free from insects and diseases. If a grower has a planting that is free from these troubles he can easily grow his own plants and thus be sure of the variety as well as freedom from diseases and insects. Plants in their first year's growth are the ones used. Plants of this age can be told by the white roots, as plants older than this have dark roots, with some of the roots black and dead.

Plants that are bought in the open market should be thoroughly inspected on arrival for the presence of insects and diseases and to see if the roots are still moist and fresh. If unsatisfactory the plants should be rejected. Plants that are but slightly dried out may be revived by immersing in water for a few hours.

If the plants are satisfactory the next step is to break the bundles open and, unless they are to be planted at once, spread them out in a shallow trench where the roots can be covered with soil to keep them from drying out. If the plants are not broken out of the bundles, the tendency will be for the roots to heat; while if not covered carefully, they will dry out. Either condition will devitalize or kill the roots.

NUMBER OF PLANTS PER ACRE

Distance apart	Plants per acre	Distance apart	Plants per acre
inches		inches	
30x18	11616	36x24	7260
30x24	8712	36x30	5808
30x30	6969	36x36	4840
36x18	9680	36x42	4148

Planting Systems. The hill system seems to be in almost universal favor with the growers on the western coast. The rows are from thirty to thirty-six inches apart, and plants in the row are from eighteen to thirty-six inches apart. Some of the more vigorously growing varieties cannot be planted closely together as the foliage makes such a luxuriant

growth and the plant needs a greater space. With the smaller growing varieties the greater distances are not to be advised unless the grower considers horse cultivation much cheaper than the hand hoeing that is otherwise necessary. Greater distances with the smaller growing varieties will necessarily cut down on the returns per acre.

In addition to the hill system the hedge row system is occasionally used, especially in irrigated districts. In this system the plants are set from eighteen to twenty-four inches apart in the rows and the runners allowed to set plants in between the original plantings so that by early summer the row is solidly filled in with plants. This system will usually give a higher yield than the hill system, although the berries do not average as high in size.

The matted row system is seldom used here on account of the difficulty of maintaining the moisture supply by cultivation. In the matted row system the plants are allowed to form runners and new plants until a row is filled to a width of two or more feet with plants. It allows no cultivation directly around the plants in the inner part of the row. It may be used in some irrigated sections if the soil is open enough and allows a good lateral distribution of the water. Only under conditions where the moisture can be maintained well into the center of the matted rows should it be considered at all. Under nearly all conditions and in most locations the use of the matted row system is not to be advised. Best results will be obtained in the long run and under most conditions by using the hill system.

Time for Planting. The main point to be observed in the time of planting is to see that the plants are set early enough so the roots will become well established before the moisture is low in the surface soil. In non-irrigated sections the late winter or early spring is preferable as the roots can be well established by early summer. Fall planting is satisfactory unless the soil is apt to become weedy over winter and necessitate an extra cleaning out in the spring, or where the winters are of a nature to cause heaving of the soil, with a resulting lifting of the plants and a breaking or drying out of the roots. Late spring planting is to be avoided at all times, for the plants do not have a chance to establish a new root system before the dry season comes on and this often results in considerable stunting of the plants. In order to establish good, healthy plants, growth must be steady and constant throughout the season.

Where irrigation water is available the necessity for early planting is much lessened as the water can be applied when the soil and plants demand it.

Preparing Plants for Setting. The roots of the plants as they usually come from the nursery are too long to be handled easily and should be trimmed off about one-third (Fig. 1). If the leaves have not been trimmed off, cut off all but one or two of the inside leaves. With a large leaf surface, moisture will be given off by the leaves faster than it can be taken in by the roots, because in digging and trimming the roots, the root system has been considerably reduced. It is necessary, then, to reduce the leaf surface to correspond to the reduced root system. As soon as the roots become established new leaves will put out and the plants will make better growth than if untrimmed.

Setting the Plants. When ready to plant, the field can be marked off in one or both directions by markers of suitable width. If the greater distances are to be used it will undoubtedly be best to mark off in two directions while with the short distances in the row accurate enough work can be done in planting without cross marking.

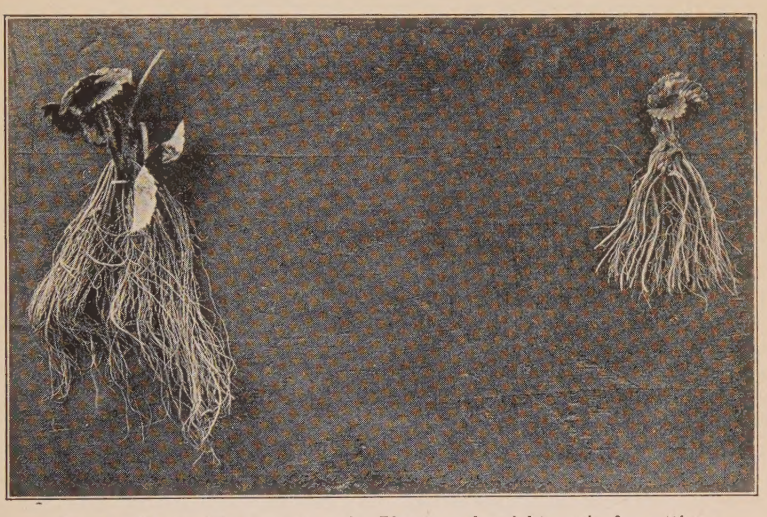

Fig. 1. Plant at left untrimmed. Plant on the right ready for setting.

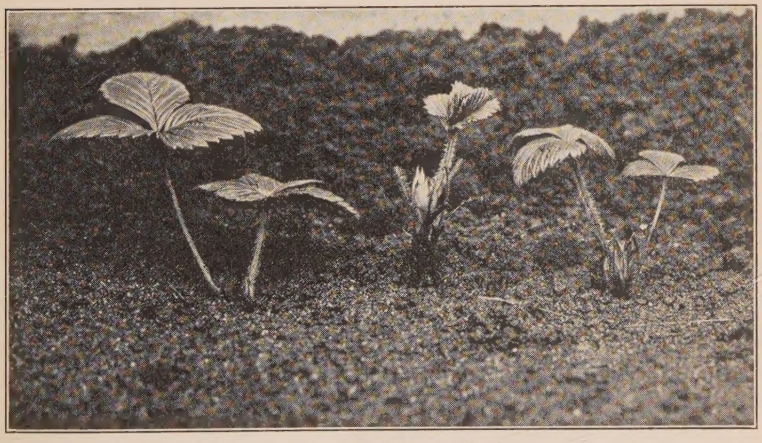

Fig. 2. Plant on left too deep. Center plant too high. Plant on right set at proper depth.

The proper depth of planting is a matter which is very important and easily overlooked. The proper depth means that the plants shall so set that the crown is level with the soil or at the same height as it originally grew in the bed. Too deep planting has a tendency to cause rotting of the crown, while too shallow planting allows the roots to dry out and die (Fig. 2).

In distributing the plants in the field care must be taken to protect the roots from drying out at any stage of the operation. For this purpose either a moist sack or a shallow bucket partly filled with water works well. If one man is dropping the plants for another man to set out, the one dropping plants should keep close enough to the one setting so that the plants can be set almost immediately after being dropped. If one man is setting out plants the dibble, trowel, or small short-handled hoe is convenient. Some men use a punch and tongs. Two men can work together, one using the spade, the other placing the plants in position.

After the plant is placed in the ground the earth should be well firmed around the roots either by stepping on the soil next to the plant or by some other method that will press the soil firmly against the roots. Even if the soil is against the plant at the surface there are very apt to be pockets of air underneath and in these pockets the roots as a rule quickly die.

CULTIVATION

The root system of the strawberry is a mass of spreading fibrous roots, running very close to the surface of the soil. On this account deep cultivation is dangerous to the plant as it will cut or break off the roots, thus depriving the plant of its food and water supply. Blighting of flowers during blooming time does not occur because cultivation is being carried on at that time but because of too deep cultivation. Shallow cultivation during bloom should be carried on as at other times. Cultivation should be frequent enough to prevent excessive evaporation of moisture and to hold it near the surface where it will be available to the shallow-growing roots. In some cases this will be every four or five days, while under different climatic or soil conditions, once in two weeks may be sufficient. Even after the fruit is off, cultivaiton should be continued so that the plants may make a satisfactory growth for the coming season, if they are to be kept over another year. It will not be necessary to cultivate them as much as before the picking season since the plants no longer have the burden of producing berries.

IRRIGATION

The rill or furrow system is most universally in use. Due to the shallow rooting system the surface soil must be kept moist, and this will necessitate more frequent irrigation than with most fruits. The water should be applied as often as the surface soil (the top two to four inches) is in need of moisture. The frequency of irrigation will depend mainly on the tillage given and the type of soil. Frequent cultivation, as soon after irrigation as possible, will reduce the number of irrigations necessary. Some of the lighter soils need more frequent irrigations than the heavy ones that retain the moisture much better. If the rill or furrow system is used, the water should be run through the whole length of the furrow fairly rapidly, thoroughly wetting the soil but not allowing any part of it to become water-logged.

As a rule the plantings are irrigated after each picking unless the soil is of such a type that it will not dry sufficiently to allow picking early the following day. In that case, half the bed may be irrigated at a

time, the pickers using the unirrigated part early in the day. After the picking season the irrigations need only be enough to keep the plants growing well. Everbearing strawberries must be irrigated constantly until fall in order to produce good crops.

In districts where irrigation is not at present practiced it may at times prove desirable. There are places in the Willamette Valley where water could be cheaply applied and two or three irrigations late in the picking season would greatly improve the crop by increasing the size of the berry. The late berries are often small, and one factor contributing to this is the lack of moisture late in the season where irrigation is not practiced and cultivation is not kept up sufficiently to insure a plentiful supply of moisture.

OTHER CULTURAL PRACTICES

If the strawberries are to be grown in hills it means constant work in keeping down the runners. The natural habit of the plant is to put out large numbers of runners to establish new plants. To maintain the plant hill the runners are kept cut off. There are several ways of doing this, but the simplest is by using a hoe that has been straightened out or a section of a sharpened saw bent in a semi-circle and attached to a light handle. Some growers use a scythe or sickle or even an ordinary hoe. There is no danger in using these instruments unless, when striking downward, the instrument might penetrate the soil deep enough to cut the roots.

During the first season the blossoms are generally kept picked off the young plants. Vigorous plants that are well established may be allowed to bear a light crop. The function of the plant for the first year, however, is to make vegetative growth, not to bear fruit. In the long run, the average planting will bring better returns if not allowed to bear fruit the first year.

LABOR REQUIREMENTS

The size of the proposed planting will often be determined by the labor supply. In irrigated sections it takes the time of one man to care for from one to three acres. Under intensive cultivation in non-irrigated sections one man may care for four or five acres. It is better to put out a small acreage rather than too large an acreage for, with a large acreage, much of the essential work will be slighted during a rush period and returns per acre will be correspondingly reduced. The big demand for labor comes during picking season when it takes six to ten people per acre to handle the crop, depending on the size of the crop.

INTERCROPPING WITH THE STRAWBERRY

Strawberries can often be grown profitably as an intercrop in a young orchard. If properly managed they can be made to pay a large part of the expense of bringing up the orchard, and especially is this so with small tracts where most of the labor is carried on by the family. Since strawberries are usually left in the ground from two to three years, allowance should be made for the size of the tree at the end of this time, by planting the strawberries outside the limit of growth that will

be made by the tree by the end of that period. The root system of the trees will have a greater horizontal spread than the top, so the strawberries should be set about two feet beyond the probable spread of the top, possibly not closer than six feet to the tree on either side. This usually allows only a comparatively small space in the center of the row, but if this plan is followed the strawberries will do well and the fruit trees will be unhindered in their development.

DURATION OF PLANTING

Plantations are productive for a period of from two to five years, but usually about two years; that is, the plants are in the ground three seasons. In many cases the largest crop is the first crop, since at that time the plants have nearly reached their maximum size and after that a certain percentage is sure to become weakened by various causes and die, thus reducing the amount of the crop.

In setting out a new plantation do not use the ground where an old plantation has just been plowed up. Allow a regular rotation of three to four years of field crops to grow before replanting. This allows the land to become free of insects and diseases affecting the strawberry.

HARVESTING AND MARKETING

The season for harvesting in this state varies from the middle of May to the last of June, depending on the variety and locality. The plantations are picked over only two or three times a week at the beginning of the season but are gone over daily during the height of the season.

The pickers generally use a six-basket carrier so that the fruit can be quickly removed to the packing shed after picking. Picking begins in the morning as soon as the berries are dry and is finished if possible before the heat of the day. Berries that are picked when moist from dew or rain do not keep well, as the moisture favors rapid development of decay organisms.

Berries are picked with a short section of the stem attached to the hull. This is done by pinching the stem between the thumb and finger. Pickers should not be allowed to crush the berry and this can be avoided by cautioning them against holding many berries in the hand. Each picker should be assigned one row and held responsible for that row. As fast as he turns in the berries he should have a ticket punched or some similar method should be used to show the number of boxes he has picked.

Berries for long distance shipments are picked while still quite firm and before they are fully ripe. For home use or local sale they are allowed to ripen fully so as to develop full flavor and sugar content. For canning and preserving they should still be firm but well ripened, while for jams they need to be as ripe as possible.

One packer ought to handle the berries of three pickers. There are various methods of packing for fresh shipment but probably the most general way is merely to sort out the small, imperfect berries, leaving only the good sound berries in each box. In some localities the box is faced with uniform-sized berries so that a crate has a top of uniform-

sized berries. This is all very well if the top layer is indicative of the size throughout the box. For selling to the cannery, grading is seldom done.

The pint and quart boxes are both in general use. According to Federal law, any box used must be in multiple of pint or quart.

Yields of strawberries vary from 100 to 300 crates per acre according to the variety and soil. While the Clark's Seedling will average one hundred and fifty crates per acre under best conditions, it will run considerably below this in other places. The Magoon and Ettersburg No. 121 under ideal conditions will go above the higher mark.

Shipments for short distances are by local express. Long shipments should be in car-load lots under refrigeration where the crates can be loaded and shipped as are apple boxes. As strawberries are so very perishable they should be loaded on cars with false floors made with two-by-four-inch stringers under the cross boards. Full directions for loading are furnished by shipping associations or by the railroads.

INSECTS AND DISEASES

(Control recommendations by Station Entomologist and Pathologist)

The strawberry has three insect pests that are serious, and several others of minor importance. The diseases of the strawberry are usually of much less importance than are the insect pests. In all cases, the first step in controlling any of these diseases or insects is healthy plants, planted in soil free from infestation of both insects and diseases.

Of the insect pests, two are usually present to a greater or less extent wherever strawberries are grown in Oregon. These are the crown miner and the root borer. The crown miner larvae, which are slender, reddish in color, construct minute tunnels throughout the crown of the plant, usually just within the bark. A few of the tunnels may run across the crown, but usually the larger number are just within the bark. The root borer, on the other hand, is white in color and more grublike in appearance. It eats out the entire heart of the crown and roots. Plants infested with the root borer readily break off at the crown or tap root. Both of these insects are controlled by digging up the infested plants and burning them.

Another very serious insect pest is the strawberry root weevil. Both the larvae and the beetle feed on the plants. The larvae feed entirely on the root system, being especially noticeable by their feeding on and eating off the small rootlets, whereby the plants are so loosened from the soil that they can be quite easily picked out of the ground.

The adults, being unable to fly, spread very slowly from one place to another. Even though the beetles feed on the foliage there is no practical way of controlling them by any spray or other means of poisoning. As soon as the plants become infested with the root weevil to such a degree that the plantation is rendered unprofitable, a new field should be planted, in soil free from the weevil, with plants procured from some section in which the weevil has not appeared.

The strawberry leaf-roller and the red spider-mite are both minor pests that can be controlled by burning off the foliage after picking season. The leaf spot is rarely serious, and usually can be controlled in the same manner as is the leaf-roller and red spider-mite. As soon as

the picking season is over, the foliage is mowed; and, in case the foliage is not heavy enough to burn of its own accord, a light dressing of straw is scattered over the field, and then at some favorable time, soon after the mowing is done, the entire foliage is burned off the field quickly.

The above-mentioned insects can be controlled in a commercial sense by using a rotation of crops. Strawberries should be allowed to bear but two years and then a fresh patch in clean ground should be made ready to produce the following year. Although these insects may always be present to a limited extent, the damage incurred by them will be reduced to a minimum.

Another pest that is becoming quite serious in some localities along the coast is the nematode. It works in the stem and leaf of the plant, causing swellings or galls of the petiole and characteristic crinklings of the leaflets. If badly infested the whole plant is wrinkled and dwarfed and non-productive. These swellings are caused by minute eel worms, the larvae, about 1/50 of an inch long, being found in the misshapen parts of the plant. Since these hatch directly from eggs and mature in about four weeks, several generations a year are produced.

The only method of combating is to destroy the patch if badly infested; or, if only a few plants are affected, the individual plants should be dug up and burned. This pest has been introduced comparatively recently but, unless energetic steps are taken to check and eradicate it, the strawberry business will soon be harassed by another most serious pest.

EVERBEARING STRAWBERRIES

Everbearing strawberries are valuable in those districts where late spring frosts do considerable damage. If the first crop is killed by frost the plants will continue to bloom and later produce a crop of berries. For home use they are desirable as they will supply fresh fruit until frost in the fall. For commercial purposes they should be considered for the late summer and fall trade, and then only when the fruit can be sold at a high price, as the cost of production of these berries is much higher than with the standard varieties. Special care is needed and the pickings continued over so long a season that extra prices must be received to make them really profitable.

Many of our common varieties, especially the Oregon and Magoon, can be made to bear a second crop late in the season. The plants can be allowed to rest for a while after the first crop and then stimulated by means of fertilizers and irrigation water into a late growth in the fall or late summer. With many of the varieties this practice will produce a light crop in the fall. Some sections can even grow the late crop with no special preparation, but even then the everbearing varieties will undoubtedly prove superior. The use of others than the everbearing varieties for fall crops is not to be recommended except possibly for home use.

Everbearing strawberries are very resistant to leaf-spot diseases. As a rule the everbearing varieties are more hardy than the common variety, with the Progressive noticeable for its hardiness against frost. Even if the bloom is killed by the frost, these same varieties soon flower again, so that the Progressive and Superb may be classed as valuable in sections of late frost, as in the high plateaus of Eastern Oregon.

Under favorable conditions they bear from the time the common varieties begin bearing until fall. A fair crop comes at the normal time, then lighter for a time; but during August, September, and October, it becomes larger.

Planting and setting the everbearing strawberries are the same as with an ordinary variety. The amount of fruit secured the first year, however, depends to a certain extent upon the time of planting. Early planting affords the plants a chance to become better established; and as a result a larger crop is obtained than with later planting. Unless the plants are very well established by having been planted early, the flowers are removed from the plants until about the first of July. This allows the plants to become larger and more thrifty for a second season if it is a variety that is left the second season, though the crop the first year is less. Fruit will begin to ripen about a month after the flowers are allowed to develop.

As these plants are bearing throughout the summer and fall, the moisture content of the soil must be kept up to a high degree. Intensive cultivation with these varieties is more necessary late in the summer and fall than with the common varieties of strawberries. Irrigation is usually necessary for high returns, though in some favorable locations it may not be necessary in order to secure the best resturns. Lack of moisture causes the crop to become small and unless the soil is especially adapted to maintaining moisture throughout the late dry season, or water is available in abundance by irrigation, the crop will be materially decreased. If any phase of berry raising in the Willamette Valley demands irrigation, it is the growing of the everbearing varieties.

If the strawberries are grown in a matted row, or hedge row, the runners are allowed to develop. If the hill system is used, the runners are entirely cut off. The Progressive is usually allowed to set runners, as these runner plants begin to fruit almost as soon as they take root. Due to the fact that they bear so early and rapidly, they are usually weakened by the end of the first year, so that the patches are renewed each year. The fruit of the Progressive variety is smaller the second year than is the fruit from the plants of the same variety that bear in the summer and autumn of the first year.

On the other hand, the Superb will bear more if the runners are kept down the first year, as runner plants rarely bear fruit the first year. The plants will bear a fair crop of good-sized berries during the summer and autumn, and then in the following spring they will bear a large crop of fair-sized berries at the same season that the ordinary berries are producing, continuing in the usual manner throughout the summer and fall of the second season. The Superb can be handled in a manner similar to that used for the ordinary varieties, leaving the plants in for two or more years.

Varieties of Everbearing Strawberries. Of the long list of everbearing varieties only three will be mentioned, and these in the order of their importance.

Progressive. Plant medium size; blossoms very resistant to cold; fruit medium size; firm with slight neck; color deep red; quality rich and sweet.

One of the hardiest varieties grown. Plants bear the first year, as do runner plants in a short time after taking root. Adapted to the richer soils. Spring crops ripen early. This is the best variety for all general purposes and the one usually recommended, especially west of the Cascade mountains.

Superb. Plant medium, vigorous, foliage very resistant to leaf-spot disease; fruit medium to large; round to conic, fairly firm; color variable, light red to dark. Quality good in summer but poor in autumn.

Does not form runner plants as readily as the Progressive and these rarely bear the first year. It is especially adapted to poorer soils provided there is a plentiful supply of water. Does not want a soil rich in nitrogen. Seems to be meeting with special favor in the irrigated sections of Eastern Oregon and in Idaho.

Americus. Plants medium vigorous; fruit medium to large; light red, often with a green tip when ripe; quality excellent.

This variety is grown very little at the present time except in home gardens and for local markets, where it is grown on account of its excellent quality.